National Aeronautics and Space Administration

EEE-INST Unified and Updates (NEPP) Program

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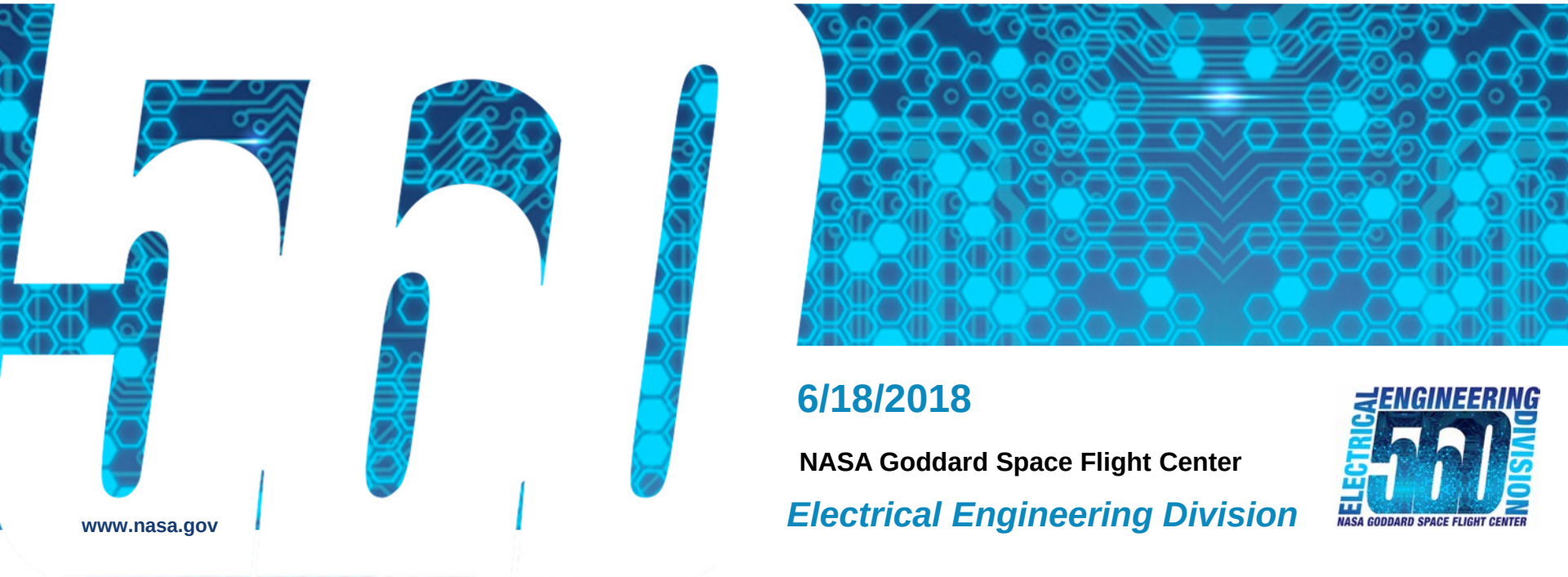

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The Goal – Develop EEE-INST-003

- To provide standardized EEE parts guidelines for multi-center use throughout NASA community.
- Update EEE-INST-002.
- Incorporate new EEE parts commodities.
- Guidance for cube-sats and Class D missions.
- Update based on NASA-STD-8739.10 Electrical, Electronic, and Electromechanical (EEE) Parts Assurance Standard released June 2017.

NASA-STD-8739.10

GRADE OR LEVEL	SUMMARY	LEVEL OF IN-PROCESS CONTROLS AND SCREENING	COST / PART	POTENTIAL UPSCREEN COST	TYPICAL USE
1	Space quality class qualified parts or equivalent.	Highest	Highest	Low	Space flight.
2	Full Military quality class qualified parts or equivalent	High	High	Medium	Space flight or critical ground support equipment.
3	Low military quality class parts and Vendor Hi-Rel or equivalent. Screened automotive grade EEE parts.	Medium	Moderate	High	Space flight experiments, cube-sats non critical space flight, critical ground support equipment, test demonstrations and ground supports systems.
4	“Commercial” quality class parts. Qualification data at manufacturer’s discretion. No government process monitors incorporated during manufacturing.	Variable	Lowest	Highest	Cube-sats, noncritical space flight, noncritical ground support equipment, ground support systems, test demonstrations and prototypes. Limited critical GSE.

NASA-STD-8739.10 Table 2 EEE Part Grade Description

Why EEE-INST-002 update needed?

- EEE-INST-002 History
  - Addendum released April 2008.
  - Original document released May 2003.
  - Based on GSFC 311-INST-001 Rev A released August 1, 1996.
  - Based on MIL-STD-975 and GSFC PPL.
- Only addresses EEE Part Quality Levels 1, 2, and 3.
- Correct errors, inconsistencies, and confusing notes.
- Address increasing usage of commercial and automotive parts.
- Address additional parts commodities.

EEE-INST-003

- Minor updates and corrections to Levels 1 and 2.
- Major changes to Level 3 and addition of Level 4.
- Similar format as EEE-INST-002 with general instructions section and commodity sections.
- Commodity Section Format --

  Introduction
  - Brief description of the commodity.
  - General guidelines and important usage factors for the commodity.

  Tables
  - Table 1 - Overall requirements for each level
  - Table 2 - Screening (100%)
  - Table 3 - Lot Acceptance Testing (LAT), (sample)
  - Table 4 - Derating criteria

Proposed EEE-INST-003 Sections

Part Category	Document Section
General Instructions for All Part Categories	1
Capacitors	C1
Capacitors, Base Metal Electrode	C2
Connectors and Contacts	C3
Crystals	C4
Crystal Oscillators	C5
Detectors	D1
Fiber Optics and Passive Components (Fiber, Cables, Connectors, and Assemblies)	F1
Filters	F2
Fuses	F3
Heaters	H1
Magnetics	M1
Microcircuits, Hybrid	M2
Microcircuits, Monolithic	M3

Part Category	Document Section
Microcircuits, ASICs and Programmable Devices	M4
Microcircuits, Monolithic Plastic Encapsulated	M5
Microcircuits, RF	M6
Microcircuits, Hybrid Plastic Encapsulated	M7
Motors	M8
Optoelectronic Devices	O1
Printed Circuit Boards	P1
Relays, Electromagnetic	R1
Resistors	R2
Semiconductor Devices, Discrete	S1
Semiconductor Devices, Plastic Encapsulated	S2
Switches	S3
Temperature Sensors	T1
Wire and Cable	W1

New sections are highlighted in blue.

Example of Table 1 Requirements

Table 1. MONOLITHIC MICROCIRCUIT REQUIREMENTS 1/, 2/

Quality Level	Monolithic Microcircuit Type	Specification	Use As Is	Screening per Table 2	LAT per Table 3	DPA
Level 1	QML Classes V, Y, S	MIL-PRF-38535	X			
	QML Classes; Q, B, M **3/**	MIL-PRF-38535		X **4/**	X	
	All Types	SCD		X	X	X
Level 2	QML Classes V, Y, S	MIL-PRF-38535	X			
	QML Classes; Q, B, M	MIL-PRF-38535		X **4/**		
	All Types	Automotive, Commerical, SCD		X	X	X
Level 3	QML Classes: V, Y, S	MIL-PRF-38535	X			
	QML Classes; Q, B, M	MIL-PRF-38535		R **4/**		
	All Types	Automotive, Commerical, SCD		X		X
Level 4	QML Classes: V, Y, S, Q, B, M	MIL-PRF-38535	X			
	All Types	Automotive, Commerical, SCD	X			

Notes:

1/ The character "X" designates a requirement. The character "R" designates a recommendation.

2/ Plastic Encapsulated Microcircuit (PEM) not addressed in this section. Devices that are encapsulated in plastic shall use the guidance in PEM section.

3/ QML Class Q, Class B, and Class M are not acceptable for Level 1 projects, except when there is no QML source of supply for Class V, Class Y or Class S device.

4/ PIND required unless already performed by manufacturer.

Example of Table 2 Screening

Table 2. MONOLITHIC MICROCIRCUITS SCREENING 1/

Test	Test Sequence	Test Methods, Conditions, and Requirements	Quality Level		
			Level 1	Level 2	Level 3
1	Wafer Lot Acceptance	MIL-STD-883, Methods 5010 Appendix II and 5007	X		
2	Nondestructive Bond Pull	MIL-STD-883, Method 2023, 2% PDA	X	X	
3	Internal Visual	MIL-STD-883, Method 2010	Condition A	Condition B	
4	Temperature Cycling	MIL-STD-883, Method 1010, Condition C, 10 Cycles min.	X	X	
5	Constant Acceleration	MIL-STD-883, Method 2001, Condition E, Y_1 Orientation Only	X		
7	PIND	MIL-STD-883, Method 2020, Condition A	X	X	R
8	Serialization		X		
9	Radiographic 2/	MIL-STD-883, Method 2012, Two Views	X		
10.	Initial Electrical Measurements	Applicable device specification at +25°C	X	X	
11	Burn-in	MIL-STD-883, Method 1015, Condition C or D.	240 hrs	160 hrs	
12	Final Electrical Measurements	Applicable device specification at +25°C, Minimum, and Maximum Operating Temperatures	X	X	R
13	Calculate Delta	25°C Pre-Post Burn-in	X		
14	Calculate PDA	Pre-Post Burn-in 25°C DC Electrical 25°C Functional	 5% 3%	 10%	
15	Seal (Hermetic Types only) a. Fine Leak b. Gross Leak	MIL-STD-883, Method 1014 Condition CH or B (or A as Alternate) for Fine Leak Condition CH, B3, or C4 for Gross Leak	 X X	 X X	
16	External Visual	MIL-STD-883, Method 2009 (3X to 10X)	X	X	X

Notes:

1/ The character "X" designates a requirement. The character "R" designates a recommendation.

2/ Only one view is required for flat packages and leadless chip carriers having lead terminal metal on four sides.

Example of Table 3 Lot Acceptance Testing

Table 3. MONOLITHIC MICROCIRCUITS LOT ACCEPTANCE TESTING 1/, 2/

Inspection/Test	Test Methods, Conditions, and Requirements	Quantity (Accept Number)	
		Level 1	Level 2
Group B		3(0)	3(0)
Solderability	MIL-STD-883, Method 2003, Soldering temperature of 245 °C ± 5 °C, 3 samples min.	22 leads(0)	22 leads(0)
Group C		45(0)	22(0) **3**/
Steady State Life Test	MIL-STD-883, Method 1005, Condition D, 1,000 hours at +125 ºC	X	X
End-Point Electrical Parameters	Per applicable device procurement specification	X	X
Package Element Evaluation			
Subgroup 1		3(0)	3(0)
Physical Dimensions	MIL-STD-883 Method 2016, Acquisition Document	X	X
Subgroup 2			
Visual Inspection	MIL-STD-883, Method 2009	100%	100%
Device Finish	Use a recognized methodology, verify all surface finishes are compliant with specification.	3(0)	3(0)
Subgroup 3		3(0)	3(0)
Thermal Shock	MIL-STD-883, Method 1011	X	X
High Temperature Bake	MIL-STD-883, Method 1008	X	X
Lead Integrity	MIL-STD-883, Method 2004		
	Condition A1 (braze attached leads, 3 lead min.)	X	X
	Condition B1 (Rigid Leads and terminals only)	X	X
	Condition B2 (Lead Fatigue)	X	X
	Condition D (Pad adhesion of leadless chip carriers)	X	X
	Condition E (Plating integrity of flexible and semi-flexible lead, 3 leads min.)	X	X
	MIL-STD-883, Method 2028 for Pin grid array leads	X	X
Seal	MIL-STD-883, Method 1014 Condition A4 Unlidded cases	X	X
Subgroup 4		3(0)	3(0)
Metal Package Isolation	MIL-STD-883 Method 1003, Condition E, 100nA max.	X	X
Subgroup 5			
Solderability	MIL-STD-883, Method 2003, Condition Soldering Temperature +245ºC ±5ºC	3(0)	3(0)

(Notes not included on this slide.)

Example of Table 4 Derating Requirements

Table 4. MONOLITHIC MICROCIRCUIT DERATING REQUIREMENTS

Derating of microcircuits is accomplished by multiplying the stress parameter by the appropriate derating factor specified below.

Stress Parameter	Derating Factor	
	Digital	Linear
Maximum Supply Voltage 1/	0.9	0.8
Maximum Input Voltage	Do not exceed 100% of derated supply voltage	Do not exceed 100% of derated supply voltage
Power Dissipation	0.8	0.75
Maximum Specified Operating Junction Temperature	Tj = +110 °C or 40 °C below the manufacturer's maximum junction temperature rating, whichever is lower.	
Maximum Output Current	0.8	0.8

Notes:

1/ For low-voltage (<= 5 V) devices, use manufacturer's recommended operating conditions as the derated limit.

Path Forward

- Thanks to NEPP support and funding, initial work is progressing well.

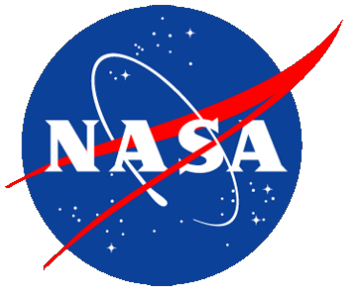
- Draft of each section will be prepared by GSFC, then reviewed by group from across NASA centers.

- Proposed Schedule

10 Draft Sections for Center Review	Summer, 2018
10 Draft Sections for Center Review	Fall, 2018
Final Draft Sections for Center Review	Winter, 2018
EEE-INST-003 Release	Spring, 2019

Technical Reference Documents

– NASA-STD-8739.10	Electrical, Electronic, and Electromechanical (EEE) Parts Assurance Standard
– EEE-INST-002	Instructions for EEE Parts Selection, Screening, Qualification and Derating
– PEM-INST-001	Instructions for Plastic Encapsulated Microcircuit (PEM) Selection, Screening, Qualification
– MSFC-STD-3012	EEE Parts Management and Control for MSFC Space Flight Hardware
– JPL D-20348	JPL Institutional Parts Program Requirements
– JSC SSQ 25001	Electrical, Electronic, and Electromechanical (EEE) Parts Upgrade Screening and Qualification Requirements
– TOR documents	Technical Requirements for Electronic Parts, Materials, and Processes Used in Space Vehicles
– SMC-S-010 (2013)	AFSC Space and Missile System Center Standard: Technical Requirements for Electronic Parts, Material, and Processes Used in Space Vehicles
– ESCC 20100	Requirements for Qualification of Standard Electronic Components for Space Application
– AEC, IPC, JEDEC, ASTM	Commercial specifications.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